

# Accident Data Research Methodology

## DATA SOURCES INITIALLY INVESTIGATED

As discussed in Chapter 8, data regarding virtually all of the characteristics pertinent to analysis of off-airport accidents is contained in the computer-based accident briefs covering all accidents investigated by the National Transportation Safety Board. Information regarding the *precise location* of each accident relative to the runway used is the key exception. To the extent that exact location information is recorded by the NTSB, it is included only in the individual Factual Record assembled for each accident. Depending upon the nature of the accident, the Factual Record may be anywhere from a dozen to hundreds of pages long. This data is maintained on microfiche and is not available in computerized form.

Prior to preparation of the 1993 edition of this *Handbook*, preliminary investigation by the study team into the Factual Records for a test group of accidents revealed that many contain the necessary location data, but most do not. Also, it was recognized that the process of extracting this information from the records would be a time-consuming one.

Other possible sources of information were therefore investigated to determine whether any could be more efficiently researched or would yield more complete or more accurate data than the NTSB records. The sources reviewed included:

- **Managers of Individual Airports**—Direct contact with the management of individual airports was the principal alternative initially considered. A major difficulty with this approach is that the completeness of the accident records maintained by different airports varies greatly. The number of years recorded, the level of detail, and the accuracy of the data from these sources would thus be inconsistent. Time-consuming follow-up letters and phone calls would be necessary in order to clarify the information received or to get any response at all. Also, correlating individual accident information obtained from airport managers with other categories of data readily available only in NTSB records would be difficult.
- **Local Newspapers**—Information from this source is essentially limited to published reports and pictures. As protection against possible erosion of first amendment rights, unpublished notes and photographs are not released to the public, even under court order. The probability of published stories or photographs adding to the information available from other sources is small.
- **Local Police and Fire Department Records**—A check with several California emergency agencies regarding specific accidents within their jurisdiction yielded little in the way of official (written) information other than that which is already included in the Factual Report. The only way this source could be useful would be to contact the individuals who went out on call and ask them to try to pinpoint the accident site.
- **State Aeronautics Offices**—Of the fifty states, only seven (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, Ohio, and Rhode Island) did any of their own investigating in 1992. Even among these seven, the investigations are usually quite limited and often done for a specific purpose (i.e., Massachusetts checks to make sure that the aircraft owner is insured or has sufficient net worth to cover damages).
- **Aircraft Owners and Pilots Association**—This organization relies almost entirely on the FAA and the NTSB for the information they collect and publish regarding accidents. There is no new or enhanced information available from this source.
- **Airline Pilots Association**—The union for airline pilots is involved in investigations of commercial air carrier accidents only and would be of no help in general aviation accident locations. Their reports on commercial accidents would shed no new light on location.

- **Aircraft Insurance Companies**—A check with two of the major general aviation insurance companies (USAIG and Associated Aviation Insurance) yielded little in the way of useful results. Except in cases where location is useful in assessing fault (such as defective navigational aid or cockpit instrument) specific accident location is not of interest, and therefore, not included. Even in cases where accurate site data is given, two problems arise. First, finding the cases that would be of use would require a hand search through individual accident reports. Second, it would probably be difficult to obtain permission to go through the files as the information is considered proprietary and also could expose the company to lawsuits.

The conclusion reached from the review of these alternative data sources was that each could provide some useful information, but—for the purposes of ascertaining accident location data—none would be as complete, accurate, or accessible as the NTSB Factual Reports.

## SUMMARY OF RESEARCH METHODOLOGY

The task of gathering the desired data was accomplished by the University of California, Berkeley, Institute of Transportation Studies working under contract to the California Department of Transportation Division of Aeronautics. The data-gathering process evolved to some extent even after the basic approach and scope of the research were decided. Three major steps were involved, each with several components:

- **Review Briefs of All Accidents**—First, a computer listing of all aircraft accident records for the selected time period was obtained from the NTSB in *minibrief* format. Each brief was then reviewed and an assessment made as to whether its location appeared to fall within the airport-vicinity range defined for the research. This process narrowed the number of accidents fitting the defined parameters to approximately 20% of the total.
- **Review of Selected Accident Factual Records**—Next, microfiche copies of the complete Factual Record for each of the selected accidents were ordered. These records were then scanned to determine whether the necessary location information was included. Location data could be found in any of several sections of the record including the investigators notes, the pilot's statement, or statements of witnesses or emergency response personnel. Only about one record in six was determined to contain usable data.
- **Preparation of Database**—Finally, location information on each accident was entered into a computer database along with the data in the other categories which had been selected. Frequently, the Factual Records identify the accident sites with reference to local streets. In order to establish the distance of the accident site from the airport runway involved, local street maps often had to be obtained and measurements taken from them. At that time, the various other categories of data for each accident were also added to the database.

## SCOPE OF RESEARCH

Beyond the principal requirement for precise accident location data, various decisions were necessary in order to define the scope of the research effort. Some of these parameters were decided by the Division of Aeronautics and the study team at the outset of the research effort; others were modified in response to the outcome of the early phases of the process.

- **Definition of Airport Vicinity**—Although the fundamental interest of the study is on off-airport accidents, an accident occurring say 2,000 feet from the end of a runway may be within the boundaries of a large

airport, but well beyond the property line of a smaller facility. Therefore, for the purposes of the analysis, *off-airport* was broadened to include any accidents not confined to the immediate vicinity of the runway (generally defined as Federal Aviation Regulations Part 77 primary surface), even if the accident site is on property actually owned by the airport. At the outer edge, a 5 mile radius—measured from the airport center in accordance with the NTSB data format—was selected as the limits of the airport vicinity. It is recognized that, at this distance from an airport, some of the accidents included may more properly be defined as en route rather than airport-related.

- **Accidents versus Incidents**—The NTSB defines an aircraft *accident* as an occurrence in which people on board or on the ground sustained serious or fatal injuries or in which the aircraft incurred substantial damage to the extent that it could no longer be considered airworthy. Other mishaps are classified as *incidents*. The NTSB and/or the FAA may conduct preliminary investigations into incidents to determine if they qualify as accidents. However, the extensive records maintained and compiled for accidents are not available for incidents. Given that the NTSB was selected as the data source for the research effort, it was necessary to exclude incidents from the database. (See Glossary for a complete definition of *aircraft accident*.)
- **Aircraft Types**—Initially, all categories of civilian-use airplanes—airline and general aviation—were to be included in the database. Very few airline aircraft accident records were actually found, however. These were eliminated from the completed database because of the statistical bias they could give to some of the data (especially with regard to the number of injuries). Helicopters and other types of aircraft are omitted because of their markedly different operational characteristics. Accidents involving military and other government aircraft are not investigated by the NTSB and therefore are excluded from the database as well.
- **Data Categories**—Although the data of central interest to the research effort was the accident location information, other categories of data also were determined to be important to the subsequent analysis of the accidents' geographic distribution pattern. Many of the data categories selected for inclusion in the database were chosen with the thought that they might prove to be significant variables affecting where accidents occur. A complete list of the categories included in the database is included in Exhibit E-1. A description of each category and the manner in which the data was obtained or determined is noted as well.
- **Time Frame Covered**—The time period to be included within the research effort was at first planned to cover a minimum of 10 years, beginning with 1980 and extending to the then most recently available data. However, the format of the NTSB's computer records essential to the initial step of the investigation was changed in 1983 and the earlier format was found to be less readily usable for the purposes of the project. The database was therefore extended to cover the 10-year period from 1983 through 1992.
- **States Included**—To enable statistically significant analysis of various subsets of accident points, a target of 500 accident records was set as the goal for the initial database development in 1993. It was anticipated that a database of this size could be obtained by review of accidents from just the 4 to 8 *sunbelt* states which generate the highest volumes of aircraft operations. However, a trial run of the process found a high rate of records which do not contain sufficiently accurate locational data. This factor necessitated extending the research scope to include all 50 states. Time and budgetary limitations, however, prevented completion of the research. The original 1993 *Handbook* database thus included records for 11 states for the years 1983–1989, while records for the other 39 states were searched only for the years 1983–1985. In the subsequent research completed in 1998, the remaining records were examined for all 50 states over the full 10-year period. The expanded database now contains records from 43 states.
- **Total Records**—The original database included a total of 400 records including records from 190 arrival accidents and 210 departure accidents. As used for the analyses presented in this *Handbook*, the expanded database contains 873 records, 445 for arrival accidents and 428 for departure accidents.

**File Data**

- Date
- NTSB File Number
- Airport Name
- Airport Identifier
- City
  - Associated city of airport involved.
- State

**Aircraft**

- Manufacturer
- Model
- Weight (Maximum Gross Takeoff Weight)
  - Obtained from Janes Aircraft or other sources.
- Number of Engines
- Engine Type
- Registration Number

**Flight Information**

- Phase of Flight (Arrival/Departure)
  - An arrival becomes a departure when:
    - A missed approach is executed during an instrument approach.
    - The aircraft leaves the ground on a touch-and-go.
    - The pilot aborts a VFR approach while under control.
  - A departure becomes an arrival when:
    - The aircraft is established downwind on a touch-and-go.
    - The aircraft is under control and established inbound on a return to the airfield, whether in an emergency or otherwise.
- Arrival/Departure Notes
- Takeoff Roll Start
  - Point where takeoff roll began if not at end of runway.
- Approach Type (VFR/IFR)
  - Flight rules category being followed at time of accident.
- Time of Day

**Airport Conditions**

- Weather
  - Weather conditions at time of accident.
- VMC/IMC
  - Whether visual meteorological conditions or instrument meteorological conditions existed.
- Light (Day/Dusk/Night)

**Runway Information**

- Runway Number
  - Duty runway used or intended to be used.
- Runway Type
  - Pavement type: asphalt, concrete, gravel, coral, grass, dirt
- Runway Heading
  - Magnetic bearing of duty runway.
- Runway Length
- Runway Width
- Available Instrument Approach Procedures
  - Available instrument approach procedures, regardless of approach type in use during accident.

**EXHIBIT E-1****Database Fields**

- Pattern Direction (Left/Right)  
As indicated in flight guides, not necessarily what the aircraft involved in the accident was intending to fly.
- FAA Tower  
Whether airport had an air traffic control tower

### **Accident Location**

- Relative Bearing  
Accident site relative bearing from arrival/departure threshold
- X Coordinate Distance  
Distance left (ñ) or right (+) of runway centerline to initial point of ground or object contact.
- Y Coordinate Distance  
For arrivals: distance from landing threshold to initial point of ground or object contact.  
(-) if site is prior to threshold; (+) if beyond landing threshold.  
For departures: distance from start of takeoff roll to initial point of ground contact.
- Distance from Departure End of Runway  
For departures only: distance along runway centerline from departure (climb-out) end of runway to initial point of ground or object contact (Y Coordinate Distance minus Runway Length).

### **Accident Characteristics**

- Pilot Control (Some/None)  
A somewhat subjective assessment of whether the pilot had some or no control over the path of the aircraft at the time of descent. Some control is judged to have occurred when the pilot materially and successfully affected the location of ground contact. For example, the pilot may have stated in record that he saw a spot for a forced landing and put down in that spot. No control of the aircraft is assumed to have existed if, for example:
  - The aircraft is observed descending in a near vertical spin.
  - The accident investigation determines that the aircraft was out of control when it crashed.
  - The aircraft was on an instrument approach, unless there is evidence that the aircraft broke free of the clouds or fog and the pilot intentionally put down in a particular location.
- Swath Length  
Distance from initial point of contact with the ground or an object on the ground to the point where the aircraft came to a stop.
- Swath Bearing
- In-Flight Collision with Object (Yes/No)  
Indicates whether the aircraft struck an object on the ground while still in flight.
- Collision Factor  
Indicates whether the collision affected where the aircraft ultimately crashed.

### **On-Board Injuries**

- Number of Fatal Injuries
- Number of Serious Injuries
- Number of Minor Injuries

### **On-Ground Injuries**

- Number of Fatal Injuries
- Number of Serious Injuries
- Number of Minor Injuries

### **Damage**

- To Aircraft (Destroyed/Substantial)
- On Ground  
Obstructs struck and extent of damage.

### **Other**

- Notes  
Miscellaneous pertinent information not included in other categories

EXHIBIT E-1 *CONTINUED*

